REMARKS

Applicants thank the Examiner for carefully considering the subject application.

Regarding the issue of double patenting with respect to US 10/714,682, Applicants submit herewith a terminal disclaimer.

Regarding the remaining issues, Applicants believe it may be helpful to review some background information before discussing the claims in detail and the applied references. Also note that claims 1, 8-11, 13-14, 17-20 and 22 have been amended.

Kobayashi et al.

As described in Applicants' "Background" and "Summary" sections, there may be situations during engine operation where there may be physical interference between the engine's valves and the piston. U.S. Patent 6,230,675 describes one situation where such interference can occur. In this example, variation in valve opening timing is combined with a low and high lift cam. Here, the potential interference is addressed by limiting the advancing of the valve opening timing only when a large valve lift is selected. Further, the limiting occurs only when valve control unit is activated and the system is in a high speed mode. This is described in Figure 9, where the system only allows the cam phase to respond to the lift that is set based on engine speed (either high speed mode or low speed mode).

The inventors herein have recognized a disadvantage with such an approach. In particular, the system always limits the advancing of the cam. However, there may be conditions where advancing the cam without limitation, but limiting valve lift, may provide improved performance or increased fuel economy. In addition, whether the valve timing or whether the valve lift should be limited can depend on various factors, such as

which actuator has a faster or slower response rate/delay. Furthermore, additional actuators can also influence the potential interference, such as variable compression ratio. The inventors herein have also recognized that the approach of '675 involves situations where there is an actuator failure. However, potential interference can occur even when both actuators are functional, yet one is moving faster or slower than another during transient conditions.

Thus, in one example, the above disadvantage of prior approaches may be overcome by limiting valve timing during some conditions, and limiting valve lift during other conditions. For example, the conditions that determine which actuator is limited may include direction of valve timing change and/or valve lift change.

By limiting different actuators in a way that takes into account a direction of change, it is possible to take the most efficient approach to reducing any piston-valve interference. In other words, if valve timing is already moving in a direction to reduce interference, the system can take advantage of that already started motion to more quickly reduce interference. Likewise, if valve lift is already moving in a direction to reduce interference, the system can take advantage of that already started motion to more quickly reduce interference.

An advantage of the above aspect is that it is possible to more quickly reduce potential for piston-valve interference. Another advantage is that it is possible to select the most appropriate actuator to reduce potential interference depending on engine or vehicle operating conditions.

Applicants can find no disclosure in Kobayashi et al. of limiting valve lift to reduce interference. In particular, there is no valve timing change direction and/or valve

lift change direction that will results in any limitation of valve lift. As such, Applicants respectfully submit that for this reason alone claim 1 is patentably distinguishable from Kobayashi et al. And for at least the above reasons, the remaining claims also distinguish Kobayashi et al.

Nakamura et al.

The Examiner also applies Nakamura et al. (US 6,575,128) to claims 1-6, 8-10, 11-16, and 17-22. Applicants respectfully disagree. In addition to utilizing the direction of valve lift change or the direction of valve timing change, the method of claim 1 also includes variable compression ratio operation. Specifically, an approach is provided that accounts for the interactive effects between variable timing, variable lift, and variable compression, all of which may affect piston/valve interference.

Nakamura et al. has no such disclosure, nor any hint as to how to structure a system that can accommodate three variable actuators, all of which may affect piston/valve interference.

The Examiner cites Col. 8, lines 43-51 as including compression ratio. These lines state:

> During this time period, lift-phase varying mechanism 2 is roughly at the maximum lag angle. This is to avoid poor combustion which becomes a problem when the engine is cold by bringing the opening timing of intake valve 12 near the bottom dead center (BDC) for enhancement of the effective compression ratio so called. Within the range of change between points "a" and "d" (vertical direction in FIG. 8), interference may not occur because of sufficient distance from the interference limit line.

As such, the above text refers to "effective" compression ratio, which those skilled in the art understand is different than an engine with variable compression ratio.

Further, even assuming the above text did in fact refer to variable compression ratio, there is still no disclosure of utilizing compression ratio as a condition for selecting valve timing and/or valve lift to reduce the potential for interference.

As such, Applicants respectfully submit that claim 1 patentably distinguishes Nakamura et al.

Kobayashi et al. in view of Aoyama et al.

As already discussed above, the claims are distinguishable from Kobayashi et al. The addition of Aoyama et al. (JP '099) does not solve this problem. Since Applicant can find no disclosure of adjusting valve timing or valve lift to reduce a potential for interference in Aoyama et al.

Kobayashi et al. in view of Nakamura et al..

As already discussed above, claim 1 is distinguishable from both Kobayashi et al. and Nakamura et al., individually. Further, the combination does not cure this defect since neither reference shows use of variable compression ratio.

Regarding claims 11 and 17, Applicants respectfully submit that even if the references are combined, there is no disclosure of adjusting engine torque to compensate for the torque effect of adjusting valve timing and/or valve lift. In other words, when valve timing and/or valve lift is adjusted to reduce the potential for interference, there may be an increase or decrease in engine output. To reduce such an impact on the vehicle operator, the approach of claims 11 and 17 adjusts engine torque to compensate for this effect. In this way, improved drive feel may be achieved.

No such disclosure can be found in Nakamura et al. or Kobayashi et al. The Examiner cites Col. 8, lines 26 through Col. 12, line 24 and Fig. 8 of Nakaumra et al.,

stating that "it is conventional in the engine controller art to have adjusted the torque of the current engine operation conditions in order to avoid the interference between a piston and an intake valve." Page 11 of the Office Action.

However, Applicants respectfully submit that the claims 11 and 17 do not use adjustments in engine torque to avoid interference. Rather, as stated, engine torque is adjusted to compensate for the effects of other actions that are taken to avoid interference. No such disclosure is even alleged to be shown in the references.

Nakamura et al. in view of Aoyama et al.

As discussed above, the approach of claim 1 provides the ability to operate with at least variable valve timing, variable valve lift, and variable compression ratio. Neither Nakamura et al. or Aoyamaet al. even hint at such operation.

For example, Nakaumra et al. provides an approach that operates with variable cam timing and variable valve lift. There is no mention of how to expand the approach to variable compression ratio. On the other hand, Aoyama et al. deals solely with variable compression ratio, with no mention of how to integrate variable valve timing or variable valve lift. While it may seem obvious with the benefit of hindsight to devise an approach to deal with variable valve timing, variable valve lift, and variable compression ratio, Applicants respectfully submit that such an approach would be improper.

Only Applicants have recognized the interrelated aspects of these interactions, and only Applicants have devised an approach to handle such interactions. One such example is described in claim 1.

Conclusion

Based on the foregoing comments, the above-identified application is believed to be in condition for allowance, and such allowance is courteously solicited. If any further amendment is necessary to advance prosecution and place this case in allowable condition, the Examiner is courteously requested to contact the undersigned by fax or telephone at the number listed below.

Please charge any cost incurred in the filing of this Amendment, along with any other costs, to Deposit Account No. 06-1510. If there are insufficient funds in this account, please charge the fees to Deposit Account No. 06-1505. A duplicate copy of this sheet is enclosed.

Respectfully Submitted,

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	Lauren Barberena